MENU | SEARCH | INDEX | DETAIL | JAPANESE

1 / 1

PATENT ABSTRACTS OF JAPAN

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(54) SHEATHING MATERIAL FOR ANTIDEWING

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a sheathing material for antidewing having excellent corrosion resistance by improving an infrared emissivity by improving a spectral emissivity in a wavelength band of a range of 4 to 6 μm in an organic polymer film of the material and reducing, for example, an antidewing cold insulation thickness of piping of an LNG plant to be operated at a low temperature.
SOLUTION: The organic polymer film having a surface roughness at a centerline mean roughness of 2 to 20 μm, a means wavelength of a waviness of 5 to 60 μm, a minimum value of a spectral emissivity in a wavelength band of a range of 4 to 6 μm of 0.5 or more and an infrared emissivity of 0.85 or more is formed on at least one surface of a metal plate.

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CLAIMS

[Claim(s)]
[Claim 1] The sheathing material for dew condensation prevention characterized by surface roughness forming at least in one side of a metal plate the organic macromolecule coat whose rate of infrared emission 2-20 micrometers and the average wavelength of a wave are 5-60 micrometers in the center line average of roughness height, the minimum value of the spectral emissivity in wavelength the region of 4-6 micrometers is 0.5 or more, and is 0.85 or more.
[Claim 2] The sheathing material for dew condensation prevention according to claim 1 characterized by shrinking said organic macromolecule coat and consisting of a coating.
[Claim 3] The sheathing material for dew condensation prevention according to claim 2 said whose contraction coating is a polyester resin system or an acrylic resin system.
[Claim 4] The sheathing material for dew condensation prevention according to claim 1 characterized by containing the aggregate whose mean particle diameter in said organic macromolecule coat is 2-60 micrometers 30 to 80% with desiccation coat mesosoma product content.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention is used for piping etc. and relates to the sheathing material for dew condensation prevention effective in dew condensation prevention.
[0002]
[Description of the Prior Art] The piping insulation condition represented in a LNG plant is influenced by the heat insulator and sheathing material which are wound around the exterior of a pipe. a conveyance fluid -- minus 100 -- as [hold / the skin temperature of a pipe sheathing material / since there is a possibility that the dew condensation which causes corrosion on a sheathing-material front face may arise when it is piping which is about dozens of degrees C / more than a dew-point] -- it sees thickness and the heat insulator more than the so-called heat insulation thickness is used. About this heat insulation thickness, it is ASTM, for example. C Although the trial calculation model is shown in 680-69, VDI2055, etc., when the heat transfer rate by the convection current is set constant, there is an inclination for heat insulation thickness to become thin, so that the emissivity on the front face of a sheathing material is high.
[0003] Current, the stainless steel plate which generally is not painted as a sheathing material, the aluminum plating steel plate, and the aluminum plate are used. Although the thinner one of the thickness of a heat insulator was desirable on construction of piping, dew condensation might be produced on the front face at the time of the part which is as low as 0.2-0.4 as for the rate of infrared emission of these sheathing materials, and becomes the day-ranges shade when a design is not appropriate, and Nighttime. When the corrosion of a sheathing material occurred and advanced according to generating of this dew condensation, exchange of a sheathing material was needed and moisture invaded into the heat insulator section further, there was a problem that adiabatic efficiency falls, become the lack of heat insulation, or also induced the corrosion of the piping itself, some internal liquids evaporated, and transportation efficiency fell remarkably.
[0004] In order to prevent above dew condensation, using with a rate [of infrared emission] of about 0.8 to 0.85 paint material for a sheathing material so that the 2-7 pages of the magazine "piping and equipment" March, 96 issues may see is examined. The trial calculation is made if reduction of heat insulation thickness can be aimed at about 20 to 30% by use of these paint material as compared with the above-mentioned sheathing material. Therefore, the bigger dew condensation prevention effectiveness can be acquired by exchanging only sheathing materials also to existing facility and piping, without changing the thickness of a heat insulator.
[0005]
[Problem(s) to be Solved by the Invention] By the way, the infrared emission property of the organic macromolecule which is the principal component of the coat of paint material has low emissivity with a wavelength of 4-6 micrometers as compared with other wavelength regions so that the part luminous-radiation spectrum of drawing 2 may see, and this has become the cause of reducing the rate of infrared emission for a full wave length region. This reason is because only the infrared energy restricted [nitrile

group] to the 4-6-micrometer wavelength region exists vibration of the proper which the frame of an organic macromolecule and a functional group have, and among rotational energy.
[0006] Since it is generally dependent on coating thickness, the emissivity of an organic macromolecule coat can make the rate of infrared emission high by making thickness increase. However, in the precoat steel plate, it was impossible for the upper limit of thickness to be set up in order to satisfy various properties, and to have enlarged the above-mentioned rate of infrared emission further. Then, only the method of making the powder which shows high emissivity to this wavelength field contain in a coat as a means which raises the rate of infrared emission was found out.
[0007] This invention offers a technical problem the sheathing material for dew condensation prevention which reduced dew condensation prevention heat insulation thickness, and was excellent in corrosion resistance in the organic macromolecule coat of a sheathing material to piping, such as a LNG plant by which the rate of infrared emission is raised, for example, low-temperature operation is carried out, by raising the spectral emissivity in wavelength the region of 4-6 micrometers.
[0008]
[Means for Solving the Problem] The mode of this invention which solved said technical problem is a sheathing material for dew condensation prevention characterized by surface roughness forming at least in one side of a metal plate the organic macromolecule coat whose rate of infrared emission 2-20 micrometers and the average wavelength of a wave are 5-60 micrometers in the center line average of roughness height, the minimum value of the spectral emissivity in wavelength the region of 4-6 micrometers is 0.5 or more, and is 0.85 or more.
[0009] In said this invention, it is desirable that it is characterized by being characterized by said organic macromolecule coat consisting of for example, a polyester system or an acrylic contraction coating, or containing the aggregate whose mean particle diameter in said organic macromolecule coat is 2-60 micrometers 30 to 80% with desiccation coat mesosoma product content.
[0010]
[Embodiment of the Invention] this invention persons found out that it was effective for surface roughness to set 2-20 micrometers and average wavelength of a wave to 5-60 micrometers for the coat front face of a sheathing material by the center line average of roughness height, and to make the minimum value of the spectral emissivity of a wavelength the region of 4-6 micrometers or more into 0.5 as an object for dew condensation prevention as an approach of raising the rate of infrared emission further (to about [0.9 or more]). Artificers presume it for the same operation as the case where pigment particle size affects the concealment nature of a paint film to work about 5-60 micrometers, then effectiveness being acquired for 2-20 micrometers and the average wavelength of a wave by the center line average of roughness height which specified the shape of surface type of an organic macromolecule coat to this invention, in order to raise the emissivity of infrared radiation with a wavelength of 4-6 micrometers.
[0011] The relation between the particle size of a color pigment and optical properties, such as reflection of light and absorption, has been studied by the researcher of the former many. Consequently, in order to obtain good hiding power and tinting strength, it is shown clearly that the optimal pigment particle size exists. Although the optimal particle size changes with the refractive indexes of a pigment, it is 1 time the particle size of the wavelength of light at a rutile type titanium dioxide with a high refractive index in the comparatively low yellow iron oxide of wavelength 1/2 twice the particle size of light, and a refractive index. From the principle of Kirchhoff, since an absorption coefficient and emissivity are equal, an absorption coefficient is replaced with emissivity and they can consider it. That is, it is drawn that the particle size to which efficient reflection of light, and absorption/radiation are performed is 1/2 or more twice as required as the wavelength of the target light at least.
[0012] In a coat front face, about the front face where roughness is big showing high emissivity as compared with a smooth front face, naturally, although it is thought that the large front face of surface roughness is because radioactivity is raised by expanding surface area, it cannot explain dividing in the radiation property of an organic macromolecule coat, and improving sharply the spectral emissivity of a field with a wavelength of 4-6 micrometers so then. The same operation as the relation between pigment

particle size, and reflection of light, and absorption/radiation property arises on a coat front face, and this invention persons guess that it is for this operation to contribute to improvement in the rate of infrared emission greatly.

[0013] Furthermore, in order to emit the infrared radiation of a field with a wavelength of 4-6 micrometers observed by this invention, it has the center line average of roughness height (2 micrometers or more and 20 micrometers or less) which is 1/2 twice the purpose wavelength, and the average wavelength of a wave becomes possible [attaining by specifying it as 5-60 micrometers]. The center line average of roughness height is smaller than 2 micrometers, or since the above-mentioned operation cannot be acquired when the average wavelength of a wave is not 5-60 micrometers, the spectral emissivity of a field with a wavelength of 4-6 micrometers made into the purpose cannot be improved. Moreover, since it is easy to produce the crack of a coat and opposite wear nature is also inferior at the time of fabrication, what has the larger center line average of roughness height than 20 micrometers does not satisfy practicality. although the front face where the minimum value of spectral emissivity with a wavelength of 4-6 micrometers is smooth is 0.3 to about 0.4 (refer to drawing 2) by forming the shape of coat surface type of this invention -- comparing -- the spectrum of drawing 1 -- it became possible to raise 0.5 or more, as shown in an emission spectrum.

[0014] It is thought that it is based on the operation explained below that a sheathing material with the high rate of infrared emission of this invention works effective in dew condensation prevention. In the environment used as a sheathing material of heat insulation piping to which the sheathing material for dew condensation prevention of this invention conveys very low temperature fluids, such as LNG, sheathing-material skin temperature will be in a low condition from the temperature of a perimeter environment. In this case, since migration of heat will be produced from a perimeter environment in the direction of a sheathing material, the temperature on the front face of a sheathing material rises, and becomes easy [maintaining more than a dew-point], so that the absorption coefficient of a sheathing material, i.e., emissivity, is high. Environmental temperature can consider exceeding a maximum of 40 degrees C in the tropical area where LNG is produced. From such an elevated temperature, infrared radiation with a wavelength of 3-50 micrometers is mainly emitted. It becomes possible to work as compared with the conventional organic macromolecule covering sheathing material in favor of maintaining sheathing-material skin temperature more than a dew-point, consequently to decrease the thickness of a heat insulator of making the 4-6-micrometer spectral emissivity of short wavelength with more large energy or more into 0.5 among the infrared radiation emitted.

[0015] this invention persons found out the approach of forming more easily the organic macromolecule coat in which the minimum value of the spectral emissivity of 4-6-micrometer region of this invention has the configuration which shows 0.5 or more. One is the approach of making a coat with the shape of surface type which chooses for example, a shrinkage coating (it is the coating which combined two or more kinds of resin with which surface tension differs from a cure rate, and be burned coating which forms the shape of toothing after hardening), and is specified to this invention paint and by being burned and making it hardening on suitable conditions forming. Especially as a resin system of a contraction coating, although not restricted, polyester resin or acrylic resin is raised, for example. As paint conditions, it is desirable as average coat thickness to form at least 12 micrometers or more. It is because the rate of infrared emission for which it depends that it is less than 12 micrometers on coat thickness becomes low reflecting the emissivity of a substrate metal plate and 0.85 or more rates of infrared emission of this invention convention cannot be attained. What is necessary is just to adopt the baking conditions of the well-known shrinkage coating for precoat metal, for example, the approach which can be burned for 30 - 120 seconds at 180-250 degrees C, as baking hardening conditions.

[0016] Another approach is an approach of making the aggregate whose mean particle diameter is 2-60 micrometers containing 30 to 80% with desiccation coat mesosoma product content in an organic macromolecule coat. If the center line average of roughness height is set to 2 micrometers or less and exceeds 60 micrometers, when the particle size of the aggregate is less than 2 micrometers, in order that the average wavelength of a wave may exceed 60 micrometers, neither of convention range of this invention is satisfied. When the desiccation coat mesosoma product content of the aggregate is less than

30%, the average wavelength of a wave exceeds 60 micrometers and the convention range of this invention is not attained. Since the ratio of the binder occupied in a coat becomes small and serves as a weak coat for which the cohesive force of a coat was insufficient, it becomes impossible to be equal to practical use on the other hand, if the desiccation coat mesosoma product content of the aggregate exceeds 80%. The coating for precoat metal with which the resin system chose at least one or more sorts of polyester resin, acrylic resin, a fluororesin, an epoxy resin, vinyl chloride resin, urethane resin, silicon resin, and silicon denaturation polyester resin is used for the organic macromolecule coat in this case, and it is just burned for 30 to 120 seconds on suitable baking conditions, for example, 180-250 degrees C. In addition, the class of aggregate does not ask inorganic substances, such as a glass bead, a silica particle, a nylon bead, a polyester bead, a polyacrylonitrile bead, a PTFE particle, and an acrylic bead, and the organic substance.

[0017] Stainless steel plates, such as a corrosion resistance good plating steel plate, for example, an aluminum plating steel plate, a zinc-aluminium alloy alloy-plating steel plate, and a galvanized steel sheet, an aluminum plate, etc. can be used for the metal plate which is a substrate of the sheathing material for dew condensation prevention of this invention.

[0018] When aiming at improvement in the rate of infrared emission furthermore, infrared quantity radioactivity ingredient powder may be added more than a kind in a coat. As such powder, there are oxide of ceramic powder and a transition element or multiple oxide powder, carbon black, etc. As ceramic powder, there are TiC, TiN, TiB2, TiO, ZrC, etc., and, specifically, there are Fe 3O4, MnO2, CoO and CuO, Cr2O3, NiO, etc. as the oxide or multiple oxide powder of a transition element.

[0019] In addition, although existence of a coat is not specified about another [which does not form the organic macromolecule coat of this invention] field, for the corrosion prevention by dew condensation, it is desirable to form a suitable coat similarly.

[0020] (Example) The example of this invention is explained below with the example of a comparison, and the conventional example.

Phosphoric-acid chromate treatment was performed to one side of the base material of the hot-dip aluminum-coated carbon steel sheet of 0.5mm of example 1 board thickness after alkaline-degreasing processing. And it painted and dried and the sheathing material was manufactured so that the coat thickness after drying the polyester resin system shrinkage coating whose rates of occupying a pigment presentation on a desiccation coat are TiO2 (0.23 micrometers of mean diameters) 50 mass % and carbon black (0.02 micrometers of mean diameters) 0.5 mass % might be set to 20 micrometers.

[0021] Except having set coat thickness after desiccation to 12 micrometers in example 2 example 1, the same actuation as an example 1 was performed, and the sheathing material was manufactured.

[0022] In example of comparison 1 example 1, except having changed the coating into the polyester resin system coating of the same pigment presentation, the same actuation as an example 1 was performed, and the sheathing material was manufactured.

[0023] In example 3 example 1, the coating was changed into the polyester resin system coating of the same pigment presentation, after mixing the nylon bead whose mean diameter is 25 micrometers so that desiccation coat mesosoma product content may become 30%, except having painted and dried, the same actuation as an example 1 was performed, and the sheathing material was manufactured.

[0024] In example 4 example 1, the coating was changed into the polyester resin system coating of the same pigment presentation, after mixing the nylon bead whose mean diameter is 25 micrometers so that desiccation coat mesosoma product content may become 80%, except having painted and dried, the same actuation as an example 1 was performed, and the sheathing material was manufactured.

[0025] In example of comparison 2 example 1, the coating was changed into the polyester resin system coating of the same pigment presentation, after mixing the nylon bead whose mean diameter is 25 micrometers so that desiccation coat mesosoma product content may become 20%, except having painted and dried, the same actuation as an example 1 was performed, and the sheathing material was manufactured.

[0026] In example of comparison 3 example 1, the coating was changed into the polyester resin system coating of the same pigment presentation, after mixing the nylon bead whose mean diameter is 70

h c g cg b eb cg e e

micrometers so that desiccation coat mesosoma product content may become 50%, except having painted and dried so that the coat thickness after desiccation might be set to 65 micrometers, the same actuation as an example 1 was performed, and the sheathing material was manufactured.
[0027] 0.5mm [of example 5 board thickness] chromium system stainless steel SUS430 After alkaline-degreasing processing, spreading mold chromate treatment liquid was applied to one side of the base material which consists of 2B finishing material, and it dried on it. And it painted and dried and the sheathing material was manufactured so that the coat thickness after drying the same polyester resin system shrinkage coating as an example 1 might be set to 20 micrometers.
[0028] After acid-washing processing, spreading mold chromate treatment liquid was applied to one side of the base material which consists of an aluminum hot-dip zinc-coated carbon steel sheet 0.5mm of 5% of example 6 board thickness, and it dried on it. And it painted and dried and the sheathing material was manufactured so that the coat thickness after drying the acrylic resin system shrinkage coating of the same pigment presentation as an example 1 might be set to 20 micrometers.
[0029] In the conventional example example 1, except having considered the coating to paint as the acrylic clearance and having set coat thickness after desiccation to 2 micrometers, the same actuation as an example 1 was performed, and the sheathing material was manufactured.
[0030] The coat property of the sheathing material respectively manufactured in examples 1-6, the examples 1-3 of a comparison, and the conventional example is shown in the following table 1. In addition, the rate of infrared emission measured the total emissivity of the range of 3-30-micrometer wavelength using the radiometer (AERD mold made from Device & Service), and made it the rate of infrared emission. Moreover, spectral emissivity with a wavelength of 4-6 micrometers is a product made from CI systems. It measured using SR IR spectroradiometer.
[0031]
[Table 1]

区　分	基材種類	樹脂系	膜厚 (μm)	赤外線放射率	放射率最小値	粗さ (μm)	平均波長 (μm)	顔料濃度 (%)	粒径 (μm)
実施例1	Alめっき鋼板	ポリエステル縮み	20	0.92	0.65	10	35	0	—
実施例2			12	0.87	0.57	7	30	0	—
比較例1		ポリエステル	20	0.80	0.35	1	150	0	—
実施例3			20	0.86	0.54	4	40	30	25
実施例4			20	0.87	0.56	6	30	80	25
比較例2			20	0.83	0.45	2	80	20	25
比較例3			65	0.84	0.47	3	100	50	70
実施例5	SUS430	ポリエステル縮み	20	0.92	0.63	10	35	0	—
実施例6	5%Al−Znめっき鋼板	アクリル縮み	20	0.90	0.60	8	35	0	—
従来例	Alめっき鋼板	アクリルクリアー	2	0.37	0.38	0.5	100	0	—

(注1) 膜厚は平均皮膜厚である。
(注2) 放射率最小値は波長4～6μmの分光放射率の最小値である。
(注3) 粗さは中心線平均あらさで、波長はうねりの平均波長である。

[0032] As shown in Table 1, surface roughness all this invention examples 1-6 by 2 micrometers or more by the center line average of roughness height 20 micrometers or less, Although it goes into the numerical limited range of this invention that the average wavelength of a wave is 60 micrometers or less in 5 micrometers or more, the minimum value of the spectral emissivity in wavelength the region of 4-6 micrometers is 0.5 or more, and the rate of infrared emission is 0.85 or more The examples 1-3 of a comparison and the conventional example have not satisfied the above-mentioned numerical limited range.

[0033] Subsequently, the trial which looks at the existence of dew condensation was performed by changing the thickness of a heat insulator. The trial was performed 20 degrees C of ambient atmospheres, and indoor [of 60% of relative humidity]. Liquid nitrogen was poured in and sealed from the inlet 2 established in the base of the cylindrical steel container (2mm of board thickness) 1 with a diameter [of 150mm], and a die length of 400mm as shown in drawing 3 . The cylindrical heat insulator 3 with a diameter [of 350mm] and a thickness of 250mm was covered on both the bases of the steel container 1, respectively. In addition, in a heat insulator, it is JIS. A The rigid-urethane-foam cast equivalent to the one-sort heat insulating board No. 2 of 9514 specification was cut down and used. Then, the same heat insulator 4 as the above was twisted and covered to setting thickness on the side face which is a measuring plane, and the sheathing material 5 shown in Table 1 was twisted around this external surface without the clearance, carried out the band stop to it, and it fixed to it. The judgment of the existence of dew condensation generating was performed by carrying out visual observation of the sheathing-material front face after checking that the temperature shown by the thermocouple contacted on steel container external surface has been held 60 minutes or more at -150 degrees C or less. Heat insulator thickness is decreased about each sheathing material, and the minimum thickness (the dew condensation non-generating minimum heat insulator thickness) to which generating of dew condensation does not take place was recorded. Results of an investigation are shown in the following table 2.

[0034]

[Table 2]

区　分	結露非発生 最小断熱材厚さ(mm)
実施例1	150
実施例2	170
比較例1	200
実施例3	180
実施例4	180
比較例2	220
比較例3	210
実施例5	150
実施例6	160
従来例	250

[0035] It turns out that the dew condensation non-generating minimum heat insulator thickness becomes small, so that the minimum value of the rate of infrared emission and spectral emissivity with a wavelength of 4-6 micrometers becomes large from Table 1 and Table 2. That is, to the dew condensation non-generating minimum heat insulator thickness becoming large in the case of the examples 1-3 of a comparison which are not the range of this invention, and the conventional example, when it is the examples 1-6 whose 4-6-micrometer spectral emissivity which is the range of this invention article is 0.5 or more and whose rates of infrared emission are 0.85 or more, it turns out that the reduction effectiveness of heat insulator thickness was acquired.

[0036]

[Effect of the Invention] This invention does the following outstanding effectiveness so.

(1) Since according to the sheathing material for dew condensation prevention of this invention concerning claim 1 it is high emissivity, and the thickness of a heat insulation cold insulator is small and ends, reduction of facility costs, such as a LNG plant, can be aimed at. Corrosion resistance improvement in a sheathing material can also be aimed at by using a paint steel plate for coincidence.

(2) According to the sheathing material for dew condensation prevention of this invention concerning

any 1 term of claim 2 - claim 4, the sheathing material for dew condensation prevention of this invention specified to claim 1 can be obtained easily.

[Translation done.]